TABLE IV

VALUES OF pn FOR 35 : 1 RATIO

N	0	1	2	3	4	5	6	7	8	9
3.....	.4295	.4176	.4060	.3947	.3837	.3731	.3627	.3526	.3428	.3333
4.....	.3241	.3151	.3063	.2978	.2895	.2815	.2737	.2661	.2587	.2515
5.....	.2445	.2377	.2311	.2247	.2184	.2124	.2065	.2007	.1952	.1897
6.....	.1844	.1793	.1744	.1695	.1648	.1602	.1558	.1515	.1473	.1432
7.....	.1392	.1353	.1316	.1279	.1244	.1209	.1175	.1143	.1111	.1080
8.....	.1050	.1021	.0993	.0965	.0938	.0912	.0887	.0862	.0838	.0815
9.....	.0792	.0770	.0749	.0728	.0708	.0688	.0669	.0651	.0632	.0615
10.....	.0598	.0581	.0565	.0549	.0534	.0519	.0505	.0491	.0477	.0464
11.....	.0451	.0439	.0426	.0414	.0403	.0392	.0381	.0370	.0360	.0350
12.....	.0340	.0331	.0322	.0313	.0304	.0296	.0287	.0279	.0272	.0264
13.....	.0257	.0250	.0243	.0236	.0229	.0223	.0217	.0211	.0205	.0199
14.....	.0194	.0188	.0183	.0178	.0173	.0168	.0164	.0159	.0155	.0150
15.....	.0146	.0142	.0138	.0134	.0131	.0127	.0123	.0120	.0117	.0113
16.....	.0110	.0107	.0104	.0101	.0098	.0096	.0093	.0091	.0088	.0086
17.....	.0083	.0081	.0079	.0076	.0074	.0072	.0070	.0068	.0066	.0065
18.....	.0063	.0061	.0059	.0058	.0056	.0055	.0053	.0052	.0050	.0049
19.....	.0047	.0046	.0045	.0044	.0042	.0041	.0040	.0039	.0038	.0037
20.....	.0036	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0029	.0028
21.....	.0027	.0026	.0025	.0025	.0024	.0023	.0023	.0022	.0021	.0021
22.....	.0020	.0020	.0019	.0019	.0018	.0018	.0017	.0017	.0016	.0016
23.....	.0015	.0015	.0015	.0014	.0014	.0013	.0013	.0013	.0012	.0012
24.....	.0012	.0011	.0011	.0011	.0010	.0010	.0010	.0010	.0009	.0009

LINKAGE BETWEEN BRACHYSM AND ADHERENCE IN MAIZE

ADHERENCE first appeared in the second generation of a brachytic x Boone Co. White hybrid and seemed to be linked closely with normal stature.[1] Subsequent progenies indicated that there was no very close linkage between these characters and possibly none at all.[2] The relationship of these two interesting characters has been tested now in more detail and it seems certain that their genes are located on the same chromosome.

A cross was made between a non-adherent brachytic plant and an adherent plant of normal stature, both plants being segregates in the F_2 of the brachytic-Boone hybrid. The first generation segregated with respect to the brachytic culms, approximately half the plants being of normal stature, but none exhibited a tendency toward adherence. From the behavior of the F_1 plants it is apparent that the adherent parent of the cross was heterozygous with respect to the brachytic character.

[1] Kempton, J. H., "A Brachytic Variation in Maize," U. S. Dept. of Agri. *Bull.* 925, Feb., 1921.

[2] Kempton, J. H., "Heritable Characters in Maize V. Adherence," *Journal of Heredity,* Vol. XI, No. 7, Sept.-Oct., 1920.

Three F_1 plants of normal stature were self-pollinated and three were back-crossed on the double recessive (adherent-brachytic). The six ears were planted separately at Arlington, Virginia, but the resulting F_2 populations were not as large as could be desired.

The combined self-pollinated progenies gave the following distribution:

No. Plants				Per Cent.			
Nor.	Br.	Ad.	Br.-Ad.	Br.	Ad.	Crossover	Q.
217	91	85	4	23.9	22.4	22.2 ± 3.4	.798 ± .06

and the plants of the combined back-crossed progenies are distributed as follows:

Nor.	Br.	Ad.	Br.-Ad.	Br.	Ad.	Crossover
86	188	178	71	49.5	47.6	30.0 ± 1.35

These distributions clearly indicate that crossing over between these two factors occurred in from 20 to 30 per cent. of the gametes.

Additional evidence of linkage between these characters is afforded by the second generation of a cross between an adherent plant of normal stature and a ramose-brachytic plant. The F_1 of this cross was normal with respect to all three characters, and they all reappeared in the progenies of the second generation. Five F_1 plants were self-pollinated and the resulting ears planted separately. Unfortunately in most of the F_2 progenies there is a deficiency of adherent plants and for the combined progenies the departure below the expected 25 per cent. is 7.8 ± .87, a deviation too large to be ascribed to chance. Whether this deficiency represents seedling mortality is not known, but at the time the plants were classified many of the progenies contained late plants strikingly smaller and weaker than their mature sisters. Some of these plants consisted of a small cluster of grasslike leaves with inflorescences hardly developed beyond the embryonic stage. Such plants could not be classified with respect to adherence, though in many cases it was possible to determine satisfactorily whether they were ramose or brachytic. With respect to these last two characters

the small late plants approximated the familiar 9–3–3–1 grouping. If the assumption is made that all these late plants were adherent, the percentage of adherent plants in most of the progenies would then approximate the expected. For the present analysis of the relationship of brachytic and adherent, the low percentage of adherent plants is not important, since the percentage of crossovers can be determined from the ratio of normal to brachytic plants or by the use of Yule's Coefficient of Association.[3]

Combining the five progenies the distribution of plants is as follows:

NUMBER OF PLANTS

Nor.	Ad.	Ra.	Br.	Ad.-Ra.	Ad.-Br.	Ra.-Br.	Ad.-Ra.-Br.	Small Plants
361	135	117	193	18	3	57	2	61

PER CENT.

Ad.	Ad. and Small Plants	Ra.	Br.
17.8 ± .87	23.2 ± .92	21.9 ± .94	27.9 ± 1.0

PER CENT. OF CROSSOVERS

Ad.-Ra.		Ad.-Br.		Ra.-Br.	
Q.	%	Q.	%	Q.	%
37 ± .06	38.5 ± 1.8	.886 ± .03	16.8 ± 1.9	.05 ± .06	49.9 ± 0.4

It is seen that the progenies of this hybrid indicate about 17 per cent. of crossing over while the three self-pollinated progenies of the other hybrid, involving brachytic and adherent, indicate 22 per cent. and the back crosses 30 per cent. It seems inadvisable to combine the self-pollinated progenies from the two hybrids to arrive at a single figure for the percentage of crossovers since the degree of crossing over between two factors often varies greatly in different progenies. It seems certain from these two hybrids that these two characters are located in the same chromosome separated by a distance varying from 18 to 30 units, thus making a linkage series of brachytic, adherent and pericarp color.

[3] Yule, G. Udney, "On the Association of Attributes in Statistics," *Phil. Trans. Roy. Soc.*, London, S. A., Vol. 94, pp. 257–319, 1900.

The progenies of the brachytic-adherent-ramose hybrid furnish evidence that the ramose character may belong to the same linkage series, though the linkage is rather loose.

Although the tassels of ramose plants are much larger than those of normal plants and it seemed not unreasonable to expect adherent-ramose tassels to present a large thickened mass, nothing of the sort was found and the ramose-adherent plants could be separated from the normal-adherent plants only by examining the ears.

White and colored seeds were planted separately, but the percentage of the three characters are essentially alike, as is shown by the following figures indicating that all three are independent of one of the aleurone factors:

	% Adherent	% Ramose	% Brachytic
White seeds planted	16.4 ± 1.65	24.3 ± 1.92	31.5 ± 2.04
Colored seeds planted	18.3 ± 1.00	21.1 ± 1.07	27.9 ± 1.17
Difference	1.9 ± 1.93	3.2 ± 2.2	3.6 ± 2.34

J. H. KEMPTON

BUREAU OF PLANT INDUSTRY,
U. S. DEPARTMENT OF AGRICULTURE

A GENE FOR THE EXTENSION OF BLACK PIGMENT IN DOMESTIC FOWLS[1]

THE results of recent experiments on the inheritance of plumage colors in fowls indicate that varieties in which black pigment extends to all or nearly all of the plumage (*e.g.*, self black) differ by one dominant autosomal gene from varieties in which black pigment is restricted to the hackle, flight and tail feathers (*e.g.*, Columbian and buff varieties). This gene has been called "extension of melanic pigment" and has been assigned the symbol E^m.

The evidence is derived from reciprocal crosses between Black Orpington and Columbian pattern (Light Brahma) fowls. Whichever way the cross is made the F_1 chicks are all black in the down. As adults, the males from the reciprocal crosses are alike. They are black with white-bordered hackles and saddle feathers; white-bordered and splashed or stippled wing coverts and narrow white borders on the upper breast feathers. They resemble fairly typical Dark Brahma or Duckwing males.

[1] Contributions in Poultry Genetics, Storrs Agr. Experiment Station.